50X1-HUM

MAR 1952

CLASSIFICATION CONFIDENTIAL
SECURITY INFORMATION
CENTRAL INTELLIGENCE AGENCY
INFORMATION FROM
FOREIGN DOCUMENTS OR RADIO BROADCASTS

REPORT

CD NO.

COUNTRY	USSR	DATE OF INFORMATION	1953
SUBJECT	Economic; Technological - Powder metallurgy, machine building		
HOW PUBLISHED	Monthly periodical	DATE DIST.	13 Nov 1953
WHERE PUBLISHED	Moscow		
DATE PUBLISHED	Jul 1953	NO. OF PAGES	6
LANGUAGE	Russian	SUPPLEMENT TO REPORT NO.	

THIS IS UNEVALUATED INFORMATION

SOURCE Vestnik Mashinostroyeniya, No 7, 1953

SOVIET SCIENTIFIC AND TECHNICAL CONFERENCE ON POWDER METALLURGY

Engr L. M. Kamionskiy

In January 1953, a scientific and technical conference on powder metallurgy, called by the Committee on Metal Saving of All-Union Council of Scientific Engineering and Technical Societies (VSNITO) in conjunction with the All-Union Scientific Engineering and Technical Society (VNITO) of Metallurgists was held in Moscow. About 200 representatives from 80 organizations (Academy of Sciences USSR, Academy of Sciences Ukrainian SSR, scientific research institutes, higher technical educational institutions, plants, and ministries) participated in the conference, which considered a number of important organizational and technical problems connected with powder metallurgy, and reached a general decision on further development of this field.

In his introductory remarks, I. A. Oding, chairman of the Committee on Metal Saving of VSNITO and Corresponding Member of the Academy of Sciences USSR, pointed out that powder metallurgy is one of the leading methods in machine building technology. Use of the method makes it possible to achieve great savings in metal by reducing sharply the amount of machining required for items produced, or eliminating it altogether; by decreasing their weight; and by utilizing as a raw material iron powders obtained from scale, chips, and other metal waste. The use of powder metallurgy opens the possibility of producing items with special properties, for example, porous bearings, items made of refractory metals -- hard alloys, copper-tungsten and other contacts. Oding noted that precedence in the development of industrial powder metallurgy belongs to the USSR. In 1827, the Russian scientist P. G. Sobolevskiy was the first in the world to produce platinum products by the powder metallurgical method. Large-scale centralized production of metal ceramic hard alloys, refractory metal products, bronze-graphite bearings, and other items has been achieved in the USSR, and the way has now been prepared for mass introduction into production of metal ceramic products with an iron powder base.

50X1-HUM

CLASSIFICATION CONFIDENTIAL

STATE		NAVY		NSRB		DISTRIBUTION					
ARMY		AIR		FBI							

50X1-HUM

V. S. Rakovskiy, Candidate of Technical Sciences, in his report "The Contemporary Status of Powder Metallurgy and Its Chief Problems" set forth the advantages of powder metallurgy in more detail. Dwelling on problems relating to the status of the theory of powder metallurgy, he remarked that Soviet science is studying the leading positions taken in this field. Although very broad and important theoretic research on the problems of pressing and sintering has been done in the USSR, the theory still lags behind the technological requirements. Individual researchers are studying the problems of some single restricted field, but they are not working out the complex problems. The basic tasks in the theory of powder metallurgy are to work out all phases in the theory of the pressing and sintering processes, taking account of all the phenomena occurring in the powdered substances; and to develop clear ideas on the specific properties of metal ceramic materials and on the interrelationship and nature of these properties. There are a number of important achievements in the field of experimental research whose successful implementation in industry is being retarded by the lack of a suitable production base. One disadvantage in the organization of scientific experimental work in powder metallurgy is the lack of contacts in carrying on research, and the almost complete absence of any exchange of experience. Powder metallurgy is a progressive technological process, and it must be widely publicized by the issuing of periodic bulletins, the production of scientific and technical films, and the inclusion of special sections on powder metallurgy in courses on the technology of metals in machine building vtuzes (higher technical educational institutions) and tekhnikums.

Academician N. T. Gudtsov stressed the sound scientific and technical basis for the use of the powder metallurgical method, which makes it possible to avoid liquation and anisotropy, defects relating to the crystallization processes in the metal. Only by the powder metallurgical method is it possible to obtain the desired comminution of the grain in the metal.

Theoretical problems of powder metallurgy were treated in the following reports: Candidate of Technical Sciences M. Yu. Bal'shin, "On the Contemporary Status of the Theory of Sintering"; Professor V. I. Likhtman, Doctor of Physical and Mathematical Sciences, and Engineer I. N. Smirnova, "Study of the Structural (Phase) Changes in the Metal Ceramic Composition of Iron-Graphite During Sintering"; and Docent V. Ye. Mikryukov, Candidate of Technical Sciences, and Engineer N. Z. Pozdnyak, "Research on the Electrical and Heat Conductivity of Metal Ceramic Alloys."

In the discussions on these reports, Professor G. A. Meyerson, Doctor of Technical Sciences, criticized Bal'shin's conception of sintering and proposed considering the strengthening of the adhesion between particles as the basic characteristic of the sintering of powders. Professor A. P. Gulyayev, Doctor of Technical Sciences, supported Likhtman's conception that all metal ceramic alloys can be studied from the viewpoint of a structural diagram. Professor G. I. Aksenov, Doctor of Technical Sciences, proposed supplementing Bal'shin's conception of sintering with the amendments of Candidate of Technical Sciences I. I. Fedorchenko, which took account of the effect of the environment. Aksenov proposed also taking into consideration Meyerson's statements on the need for surface strength in pressing. Aksenov introduced his idea on the necessity of drawing on the whole field of metalworking for developing all the processes involved in producing metal ceramic products.

A number of reports were devoted to various methods of producing iron powders. Candidate of Technical Sciences N. N. Timoshenko discussed the properties of an iron powder obtained at a plant of the Ministry of the Metallurgical Industry. This powder, which contains 98.6 percent iron, 0.13-0.15 percent carbon (graphite) and 0.2-0.4 percent silicon, has a bulk density of 1.8 grams per cubic centimeter [g/cm^2 in text], and about 60 percent of the particles are less than 0.046 millimeter in size. In the unannealed state, it is suitable for oxygen-flux cutting,

Sanitized Copy Approved for Release 2011/09/14 : CIA-RDP80-00809A000700150022-9

for magnetic detection of defects, and for the mass production of metal ceramic products, its own production cost being comparatively low. For the production of iron powders for a particularly crucial purpose, it is recommended that the powder be annealed in a protecting atmosphere. GOSTs must be worked out for iron powders, to serve as a basis, not for the method of producing them, but for their chemical composition. It is suggested that the iron powders be divided into five grades:

Grade A (98.5% Fe; 0.05% C; 0.05% Si; 0.05% Mn; 0.02% S; 0.01% P)

Grade B (98.0% Fe; 0.05% C; 0.25% Si; 0.5% Mn)

Grade V (96.0% Fe; 0.15% C; 0.45% Si; 0.5% Mn)

Grade G (94.0% Fe; 0.25% C; 1.00% Si; 0.5% Mn)

Grade D (91.0% Fe; 0.25% C; Si and Mn by agreement)

I. N. Frantsevich, Corresponding Member of the Academy of Sciences Ukrainian SSR, and I. F. Rodomysl'skiy, Candidate of Technical Sciences, reported on the description, properties, and fields of use of an iron powder produced at the Academy of Sciences Ukrainian SSR by reprocessing pyrite cinders and reducing them with natural gas. Scarcely differing in composition from a powder obtained by the vortical method, the powder of the Academy of Sciences Ukrainian SSR shows a higher degree of strength and plasticity in metal ceramic products. In producing the powder by the technology worked out at the Academy of Sciences Ukrainian SSR, with production automatized on a large scale, the cost will be much less than for powders produced by other methods.

Docent M. V. Ionin told of a method of obtaining iron powder from steel chips or pyrite cinders by preliminary hydrolysis of chlorides, and subsequent reduction of the iron oxides with hydrogen. The powder obtained from the steel chips has a bulk density of 0.8-1.3 grams per cubic centimeter, and a lower content of carbon, silicon, phosphorus, sulfur, and other impurities than the initial chips. There is no specific screen size for this powder. It can be reduced to the stage where 95 percent of it will pass through screen 12,000. The powder obtained from pyrite cinders has a 98-99 percent total iron content, 0.012-0.040 percent sulfur, and traces of manganese. The cost of the powder made from pyrite cinders is $1\frac{1}{2}$ times the cost of the powder produced from steel chips.

Engineer A. S. Fedorishchenko reported on a simple and inexpensive technology for obtaining a steel powder with 0.5-1 percent carbon content from cast iron chips. The method consists of graphitizing annealing of the chips to decrease their content of combined carbon, and pulverizing the annealed chips in a ball mill in an aqueous solution of sodium carbonate and sodium hydroxide /NOH in text/. This process washes and refines the metal powder, and the graphite and other nonmetallic impurities are carried off by decantation. Fedorishchenko recommends testing the use of the steel powder obtained by this method, not only in pure form, but also as an admixture to iron powder, for producing metal ceramic machine parts.

Candidate of Technical Sciences A. F. Silayev devoted his report to the production of metal powders by pulverizing melts in a gas medium by the centrifugal method. The production of powders of iron, ferroalloys, steels, phosphorized copper, and a number of pure metals by this method was first accomplished in the USSR. In mass production, the productivity of one unit can reach 5 tons per hour, which ensures low cost of the metal powders obtained in this way.

One of the basic prospective fields for using the technology of powder metallurgy is the production of porous metal ceramic bearings, first with an iron powder base. The reports of Engineer P. I. Bebnev, Engineer P. V. Semencha, Candidate

50X1-HUM

of Technical Sciences A. Ye. Omel'yanov, Engineer A. S. Mukhin, Yu. F. Morozov, Engineer V. V. Saklinskiy, and Engineer M. T. Vasil'yev were concerned with this question.

The porous iron-graphite bearings devised and developed in the USSR surpass bronze and babbitt bearings in a number of properties. As a result of improvement in the technology of producing porous iron-graphite bearings, the mechanical strength of the porous iron, according to Bebnev's data, is equal to, and in some cases exceeds the strength of cast bronze and antifriction cast iron; the coefficient of friction and the wear of the porous iron are less than those of babbitts B83 and BN, and of bronze; the maximum permissible loads, under smooth operating conditions, and with sufficient lubrication, are greater than for tin bronze OTsS 6-6-3 or antifriction cast iron SChTs-2. Iron-graphite bearings with 25 percent porosity permit the following loads (depending on the peripheral speed):

v (m/sec)	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
p (kg/sq cm)	70	65	60	55	45	30	15	5

With an optimum porosity of 15-20 percent, the maximum permissible loads can be greatly increased. For example, when v equals 2.5 meters per second, porous iron bearings can be used with loads up to 65 kilograms per square centimeter.

Semencha described the use of porous iron bushings instead of ball bearings in the rubber rollers of conveyers used in the coal industry. These bushings, operating at maximum values of P = 20 kilograms per square centimeter and v = 1 meter per second, greatly surpass ball bearings in durability and do not require elaborate maintenance, even under very dusty conditions. The oil chamber of the rubber seal protects the metal ceramic bushings from falling coal dust and prevents clogging. In 1952, about 200 tons of ball bearing steel were saved in the coal industry as a result of introducing metal ceramic bushings.

The production capacities of the metal ceramic shop which produces porous metal ceramic iron bushings for the coal industry are such that it can fill orders for enterprises of other ministries.

Omel'yanov reported that testing of metal ceramic iron bushings on a self-propelled combine and a flax puller showed advantages of these bushings over bronzes and fast wearing cast irons. Bushings with a 30 percent porosity at a peripheral speed of 0.8 meter per second, with constant lubrication and protection from abrasive dust, can operate at specific pressures of up to 44-48 kilograms per square centimeter. The capacity of these bushings to operate for a considerable period of time without supplementary lubrication makes it possible to recommend their use in agricultural machinery under conditions where regular lubrication is difficult. (In laboratory testing, a porous iron bushing operated for more than 970 hours at v = 0.8 meter per second and P = 6 kilograms per square centimeter, with a single application, 5.2 grams, of lubricant grease.) It is necessary only to provide maximum protection in order to prevent dust and other abrasives from falling on to the friction surface of the bushings.

Saklinskiy discussed the technology worked out in the motor vehicle industry for producing by powder metallurgical methods thin-walled steel-lead-bronze diesel bushings, trimetallic motor vehicle bushings, and bimetallic bearing-bushings. The results of 1,300-hour periods of testing of metal ceramic bimetallic bushings in diesels confirmed the expediency of the proposed process. The production of such bushings, in comparison with the production of bushings by the pouring method, results in a 30 percent reduction in labor consumption, reduction of the consumption of lead bronze to one third or one fourth the previous consumption, and simplification of the technological process. Stand testing of the trimetallic bushings (steel, an intermediate porous metal ceramic layer, and lead babbitt with a 3 percent tin content) showed a durability two to three times that of the ordinary thin-walled steel-babbitt bushings.

According to Mukhin, on the basis of operational plant testing, a proposal is being made to initiate the production of a number of iron-graphite motor vehicle parts for replacing parts of rod brass LS 59-1 and secondary tin bronze, as well as to make partial substitution of iron-graphite bushings for ball bearings.

A significant increase in the period of service of metal ceramic antifriction parts is achieved, according to the report of Frantsevich, by impregnating them, in a vacuum, with the colloidal metal lubricants developed by the Institute of Physical Chemistry, Academy of Sciences Ukrainian SSR. For instance, in the case of the Kiev trolley bus, the period of service of iron ceramic collector shoes with colloidal metal lubrication is 30-40 shifts, whereas bronze-graphite collector shoes are serviceable for only two to three shifts. At the same time, the wear on the trolleys is sharply reduced.

Vasil'yev's report aroused great interest at the conference. A method of electrical pressing which he developed makes it possible to produce different porous antifriction materials (in particular, aluminum-iron alloys, porous cast iron, etc.) and to manufacture products from them, as well as to produce compact products from metal waste and metal powders, on special electric presses or ordinary low-duty presses with the use of electrified dies. The electrical pressing method is characterized by combining, at the proper time, the processes of pressing and sintering; by eliminating the need for a special reducing atmosphere; and by using specific pressures many times less than with the usual cold pressing technology.

The use of the powder metallurgical method is also envisaged for producing compact structural parts. Rakovskiy's report gave data on introducing into production at a ball bearing plant a technology for making metal ceramic semiporous (with a 7-8 percent porosity) products, ball bearing separators and nut fasteners for bearings, from waste powders acquired in the machining of balls.

Theoretically, the period of service of brass separators is 500 hours. However, in testing metal ceramic separators, they were considered suitable for further operation after 1,347, 925, and 1,638 hours of operation.

Conversion to metal ceramic separators means a saving of 420 kilograms of brass for every 1,000 separators; and conversion to metal ceramic nuts means a saving of about 2 tons of steel for each ton of nuts, a reduction in labor consumption of 25 man-hours for 1,000 nuts, and a 30-50 percent decrease in production cost.

Aksenov reported on a method which he developed for rolling thin strip from metal powders.

Engineer V. S. Poroykova reported that a considerable saving in electric power results from the use of porous metal ceramic iron electrodes in electrochemical processes for obtaining hydrogen, oxygen, chlorine, and permanganate, as well as in the storage battery industry. This saving is achieved in connection with reducing the overvoltage of the hydrogen at the porous electrodes owing to their highly active surface.

A report by Engineer L. A. Kovsharova gave data on the use of metal ceramic electrode-tools in producing and repairing by the electrical erosion method hammer dies for the production of large items of complex form. This process results in a saving of metal, a sharp reduction in labor consumption and production cost, and an increase in the durability of the electrode-tools.

Engineer V. A. Khazov reported on production experience in making seals from iron powder by the metal ceramic method as a substitute for lead seals.

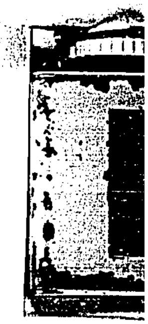
[redacted] 50X1-HUM

CONFIDENTIAL

Docent N. F. Vyaznikov, Candidate of Technical Sciences, reported considerable simplification of the process of sintering under light production conditions, by carrying it out in solid carburizing agents. The sintering of porous iron blanks for cash register bushings is being done successfully in pure carbon powder in 4 hours at a temperature of 950 degrees.

There are great prospects for using iron powders in welding technology, for oxygen-flux cutting, and in the aniline dye industry. The report of Engineer L. M. [illegible]fner was devoted to the first of these uses

The discussions threw light on other fields for using powder metallurgy. In particular, Candidate of Technical Sciences Al'tman pointed out the need for further expansion of the use of metal ceramic contacts and permanent magnets in the USSR. Engineer I. S. Pekker proposed organizing widespread testing of metal ceramic filters for oil regeneration.



- E N D -

[redacted] 50X1-HUM

CONFIDENTIAL

Sanitized Copy Approved for Release 2011/09/14 : CIA-RDP80-00809A000700150022-9